PAPER PICKUP MECHANISM

BACKGROUND OF THE INVENTION

Field of Invention

The present invention relates to a paper pickup mechanism, and more particularly, to a paper pickup mechanism that provides an equal pickup force under different paper loads, and operates with high precision.

Related Art

Usually, a paper pickup mechanism of various types such as a copy machine, a fax machine and a printer has two rubber rollers respectively with high coefficients of friction. One of the rubber rollers is a pickup roller and the other is a feed roller. A topmost paper of the paper load stack is picked by the pickup roller and conveyed to a printing module by a feed roller.

In a traditional paper pickup mechanism that uses a pickup roller to pick up paper, driving energy is usually dissipated through the gear mechanism, and noise is produced due to the friction between two contacting rollers when the papers are transmitted. Therefore, a reduced number of rollers are preferable to reduce inter-roller friction. Furthermore, multi-feeds or feed failure may occur due to weight, density or stiffness of papers.

The rollers may be movable for automatic compensation of the pickup roller. One common approach is to mount the pickup roller at one swing arm or at one end of a set of gears, as disclosed in US Patent No. 5527026. This can automatically compensate the pickup force for different types of papers. However, for one type of paper, the swing range of the pickup roller, being mounted at one swing arm and operating under a different paper load,

must be large. This mount provides non-uniform pickup forces, which results in unsatisfactory operational precision.

SUMMARY OF INVENTION

Therefore, the invention provides a paper pickup mechanism that solves the problems of the prior art such as non-uniform pickup forces under different paper loads and low operational precision.

In order to achieve the above and other objectives, the paper pickup mechanism of the invention includes a plurality of driving gears, a plurality of connecting rods, a pickup roller and a twist restricting gear. The pickup roller is driven in rotation and sliding move to cause a topmost paper to move. The twist restricting gear engages with one of the driving gears and rotates only when being subjected to a twist force greater than a predetermined twist force. The twist restricting gear thereby restricts the pickup operation of the pickup roller to provide a constant pickup force under different paper loads.

Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given herein below illustration only, and thus are not limitative of the present invention, and wherein:

FIG. 1 is a perspective view of a paper pickup mechanism according to one embodiment of the invention, the broken line indicating the boundary of a feeder;

FIG. 2 is a perspective view of a paper pickup mechanism taken from a different angle of view according to one embodiment of the invention, the broken line indicating the boundary of the feeder;

FIG. 3 is a schematic view illustrating the operation of a paper pickup mechanism outside a feeder when paper is not picked up, according to one embodiment of the invention;

FIG. 4 is a schematic view illustrating the operation of a paper pickup mechanism inside a feeder when paper is not picked up, according to one embodiment of the invention;

FIG. 5 is a schematic view illustrating the operation of a paper pickup mechanism outside a feeder when paper is picked up, according to one embodiment of the invention; and

FIG. 6 is a schematic view illustrating the operation of a paper pickup mechanism inside a feeder when paper is picked up, according to one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. 1 to FIG. 6, a paper pickup mechanism 100 according to one preferred embodiment of the invention is mounted on a vertical type feed tray 200. The paper pickup mechanism 100 includes a set of driving gears 110, a pickup roller 120, a set of swing arms 130, a twist limiter 140 and a twist restricting gear 150. The arrangement and operation of the above components are described below.

Referring to FIG. 1 and FIG. 2, the set of driving gears 110 includes a power input gear 111, a first internal gear 112, a second internal gear 113, a transmission gear 114, a first connecting rod 115 and a second connecting rod 116. The power input gear 111 inputs a driving power. The first and second internal gears 112, 113 engage with each other. The

power input gear 111 engages with the first internal gear 112. The second internal gear 113 further engages with the transmission gear 114. The power input gear 111, the first internal gear 112 and the second internal gear 113 interconnect with the first connecting rod 115 of a substantial L shape. The second internal gear 113 and the transmission gear 114 interconnect with the second connection rod 116. In the above configuration, the transmission gear is movably located at the lowest position. When the power input gear 111 rotates to drive the related gears in rotation, friction between the gears and the connecting rods drives the transmission gear 114 in rotation and sliding move. Furthermore, the transmission gear 114 pivotally connects with a pickup shaft 121 that extends through a sidewall slot 210 into a feeder 200.

The pickup roller 120 has a high-friction picking surface to contact with the paper to be fed. The pickup roller 120 is mounted inside the feeder 200 to pivotally connect to the pickup shaft 121. The sidewall slot 210, through which the pickup shaft 200 penetrates, has a profile shaped in an inclined curve. The sidewall slot 210 has an inner radius larger at its top edge than at other portions, to position the transmission gear 114 at a higher level when the transmission gear 114 is not in operation. In other words, the pickup roller 120 is also located at a higher level so that the inner space of the feeder is larger for greater paper load.

The set of swing arms 130 includes a first arm 131 and a second arm 132 which connect to each other. A top of the first arm 131 connects to a suspended arm 220 that stretches across the feeder 200. A bottom of the swing arm 132 connects to the pickup roller 120.

The twist limiter 140 is mounted outside the feeder 200, below the transmission gear 114. The twist restricting gear 150 pivotally connects to the transmission gear 114 in a manner that when the transmission gear 114 moves, the transmission gear 114 engages with the twist restricting gear 150. The twist limiter 140 provides a twist force to the twist restricting gear 150. The twist restricting gear 150 rotates only when a twist force greater than a predetermined twist force is applied thereon. The predetermined twist force is determined based on the twist force required for conveying the paper when the pickup roller 120 contacts

with the paper. Practically, the twist limiter 140 is a twist spring or other damping device. If a damping fluid is applied over the shaft of the twist restricting gear 150 to provide enough resistance, the twist limiter 140 can be omitted.

Referring to FIG. 3 and FIG. 4 in conjunction with FIG. 1 and FIG. 2, in the paper pickup operation, the power input roller 111 provides a counterclockwise rotational force to sequentially drive the first and second internal gears 112, 113 and the transmission gear 114 in rotation, the transmission gear 114 descends from the top edge of the sidewall slot 210 until it contacts with the twist restricting gear 150. The pickup roller 120 rotates and moves as the transmission gear 114 acts. The pickup roller 120 and the transmission gear 114 are movable. Therefore, the twist force supplied by the power source does not need to be as high as that supplied by the twist limiter 140. In other words, the twist restricting gear 150 does not rotate at this moment, and the transmission gear 114 moves toward a paper 230 and, meanwhile, rotates and engages with the twist restricting gear 150.

Referring to FIG. 5 and FIG. 6, after the pickup roller 120 comes in contact with the paper 230, the friction between the pickup roller 120 and the paper 230 increases the twist force required to keep the transmission gear 114 rotating. When the twist force transmitted from the set of driving gears 110 is greater than the predetermined twist force of the twister limiter 140, the twist restricting gear 150 and the transmission gear 114 are driven in rotation simultaneously to drive the pickup roller 120 to convey the paper 230. When the paper 230 moves to the feeding roller (not shown), the power source supplies a reverse twist force to allow the above components to turn back to their original positions.

As described above, the transmission gear is supplied with a predetermined twist force to limit the pickup force to a constant value regardless of the paper load, which may include 200 or 5 paper sheets. Furthermore, with the twist restricting gear, the moving path of the pickup roller is well controlled to increase operational precision.

To achieve an automatic compensation under different paper loads, a twist force adjustment means may be further provided to adjust the predetermined twist force.

It is noted that the mechanism used to drive the transmission gear and pickup roller is not limited to those described above. For example, the number and arrangement of swing arms are not particularly limited to the above embodiments. A person skilled in the art can readily understand that the swing arms are equivalent to the connecting rods. The set of driving gears may include, in addition to the transmission gears, various assemblies of gears and connecting rods. Furthermore, the number of sets of driving gears is not particularly limited to the description herein.

Furthermore, the transmission gear, the twist limiter and the twist restricting gear may be located at positions other that the outside of the feeder. One variation of the paper pickup mechanism of the invention can be also applied to a transversal type feeder.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.